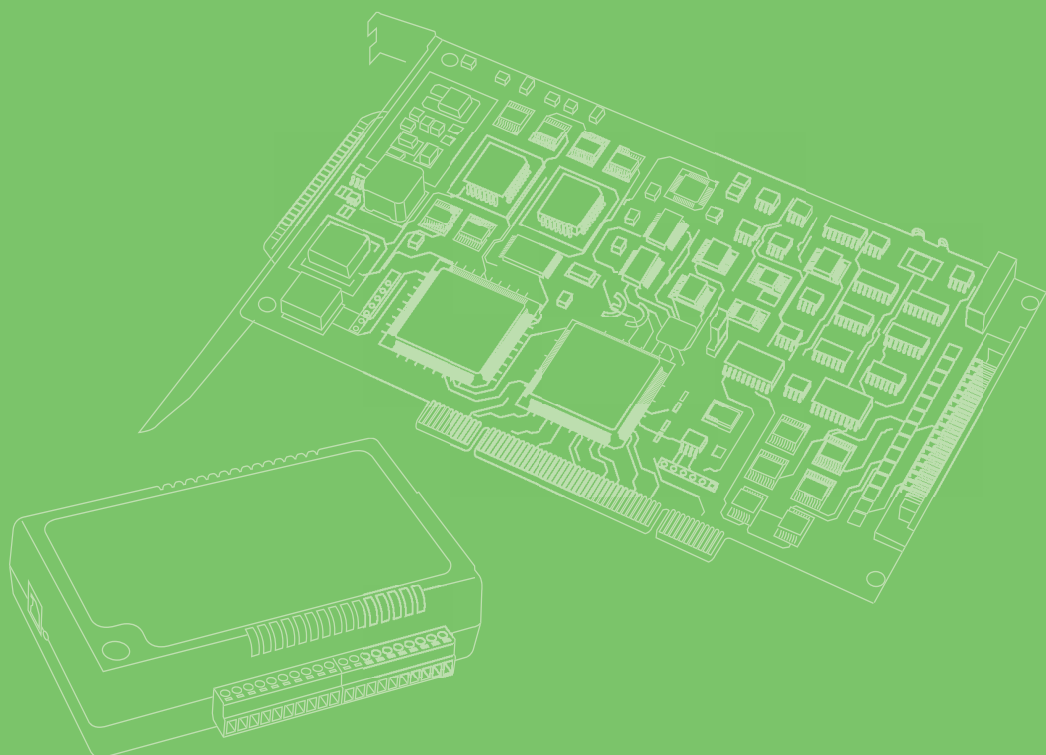# User Manual

PCM-3725

8-ch Relay and Isolated Digital Input PC/104 Module

ADVANTECH

Enabling an Intelligent Planet

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Product Warranty (2 years)

Advantech warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages you get when the problem occurs.

2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.

3. If your product is diagnosed as defective, obtain an RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.

4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.

5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

Declaration of Conformity

CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech.

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If any of these situations arise, get the equipment checked:
    – The power cord or plug is damaged.
    – Liquid has penetrated into the equipment.
    – The equipment has been exposed to moisture.
    – The equipment does not work well, or you cannot get it to work according to the user's manual.
    – The equipment has been dropped and damaged.
    – The equipment has obvious signs of breakage.
15. DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.
16. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
17. The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Contents

Chapter 1

Overview

1.1 Introduction

The PCM-3725 is a 8-ch relay actuator and 8-ch isolated digital input module that attaches to the PC/104 connector on your CPU card or PC/104 module. It offers eight relay actuators and 8-bit isolated digital input channels.

Its eight on-board SPDT relays are ideal for applications such as device On/Off control or low power switching. A red LED next to each relay shows its On/Off status for easy monitoring. The PCM-3725's eight optically-isolated digital input channels are ideal for digital input in noisy environments or with floating potentials.

1.2 Features

- 8 relay actuator outputs
- 8 opto-isolated digital inputs
- LED indicators to show activated relays
- Onboard relay driver circuits
- Onboard input signal conditioning circuits
- Easy to use and program

1.3 Applications

- Digital signal sensing
- Switch contact status sensing
- Limit switch monitoring
- BCD interface
- Industrial on/off control
- Signal switching
- Valve/solenoid control
- External high power relay driving
- Alarm activating
- Annunciator control
- Industrial automation
- Laboratory automation
- Useful with A/D's and D/A's

1.4 Specifications

Isolated Digital Input

Table 1.1: Isolated Digital Input		
Number of Input Channel	8	
Optical Isolation	2500 V	
Opto-isolator response time	25 µs	
Over-voltage Protect	70 V_{DC}	
Input Voltage	VIH (max.)	50 V_{DC}
	VIH (min.)	10 V_{DC}
	VIL (max.)	3 V_{DC}
Input Current	10 V_{DC}	1.7 mA (typical)
	12 V_{DC}	2.1 mA (typical)
	24 V	4.4 mA (typical)
	48 V_{DC}	9.0 mA (typical)
	50 V	9.4 mA (typical)

Relay Output

Table 1.2: Relay Output	
Number of Output Channel	8
Relay Type	SPDT (Form C)
Nominal Switching Capacity	1.5 A @ 30 V_{DC}
Max. Switching Power	45 W
Max. Switching Voltage	220 V_{DC}
Max. Switching Current	1.5 A
Min. Switching Capacity	10 µA @ 10m V_{DC}
Breakdown Voltage	2,000 Vrms for 1 min. (Between contact and coil)
Operating time	4 ms max.
Release time	4 ms max.
Resistance	Contact:100 mΩ; Insulation: 1 GΩ @ 500 V_{DC}
Life Expectancy	10^5 min. @ 2 A, 30 V_{DC}

General

Table 1.3: General		
Power Consumption	+5V @100 mA (typical) +5V @280 mA (max.)	
Digital Input Connector	20-pin post header	
Relay Output Connector	50-pin post header	
Dimensions	96 x 90 mm (3.7" x 3.5")	
Temperature	Operation	0 ~ 60°C within Vin <= 30 V 0 ~ 30°C within 30 V < Vin <= 50 V
	Storage	-20 ~ +70°C (-4 ~ 158°F)
Relative Humidity	5 - 95 % RH non-condensing (refer to IEC 68-2-3)	
Certification	CE Class A certified	

1.5 Software Overview

Advantech offers a rich set of DLL drivers, third-party driver support and application software to help fully exploit the functions of your PCM-3725 card:

- Device Drivers (on the companion DVD-ROM)
- LabVIEW driver
- Advantech DAQ NAVi
- Datalogger

Programming choices for DA&C cards

You may use Advantech application software such as Advantech Device Drivers. On the other hand, advanced users can use register-level Programming, although this is not recommended due to its laborious and time-consuming nature.

DAQNavi Software

Advantech DAQNavi software includes device drivers and SDK which features a complete I/O function library to help boost your application performance. This software is included in the companion DVD-ROM at no extra charge and comes with all Advantech DA&C cards. The Advantech DAQNavi software for Windows XP/Vista/7 works seamlessly with development tools such as Visual Studio .Net, Visual C++, Visual Basic and Borland Delphi.

1.6 DAQNavi Device Driver Programming Roadmap

This section will provide you a roadmap to demonstrate how to build an application from scratch using Advantech DLL driver with your favorite development tools such as Visual C++, Visual Basic, Delphi and C++ Builder. The step-by-step instructions on how to build your own applications using each development tool will be given in the DAQNavi SDK Manual. Moreover, a rich set of example source codes are also given for your reference.

Programming Tools

Programmers can develop application programs with their favorite development tools:

- Visual C++
- Visual Basic
- Delphi
- C++ Builder

For instructions on how to begin programming works in each development tool, Advantech offers a Tutorial Chapter in the DAQNavi SDK Manual for your reference. Please refer to the corresponding sections in this chapter on the DAQNavi SDK Manual to begin your programming efforts. You can also take a look at the example source codes provided for each programming tool, since they can get you very well-oriented.

The DAQNavi SDK Manual can be found on the companion CD-ROM. Or if you have already installed the DAQNavi SDK Manual on your system, The DAQNavi SDK Manual can be readily accessed through the Start button:

Start/Programs/Advantech Automation/DAQNavi/DAQNavi Manuals/DAQNavi SDK Manual

The example source code could be found under the corresponding installation folder such as the default installation path: ***\Advantech\DAQNavi\Examples***

For information about using other function groups or other development tools, please

refer to the Using DAQNavi SDK chapter in the DAQNavi SDK Manual, or the video tutorials in the Advantech Navigator.

Programming with DAQNavi Device Drivers Function Library

Advantech DAQNavi Device Drivers offer a rich function library that can be utilized in various application programs. This function library consists of numerous APIs that support many development tools, such as Visual Studio .Net, Visual C++, Visual Basic, Delphi and C++ Builder.

According to their specific functions or services, APIs can be categorized into several function groups:

- Analog Input Function Group
- Analog Output Function Group
- Digital Input/Output Function Group
- Counter Function Group
- Port Function Group (direct I/O)
- Event Function Group

For the usage and parameters of each function, please refer to the Using DAQNavi SDK chapter in the DAQNavi SDK Manual.

Troubleshooting DAQNavi Device Drivers Error

Driver functions will return a status code when they are called to perform a certain task for the application. When a function returns a code that is not zero, it means the function has failed to perform its designated function. To troubleshoot the Device Drivers error, you can pass the error, you can check the error code and error description within the Error Control of each function in the DAQNavi SDK Manual.

1.7 Block Diagram
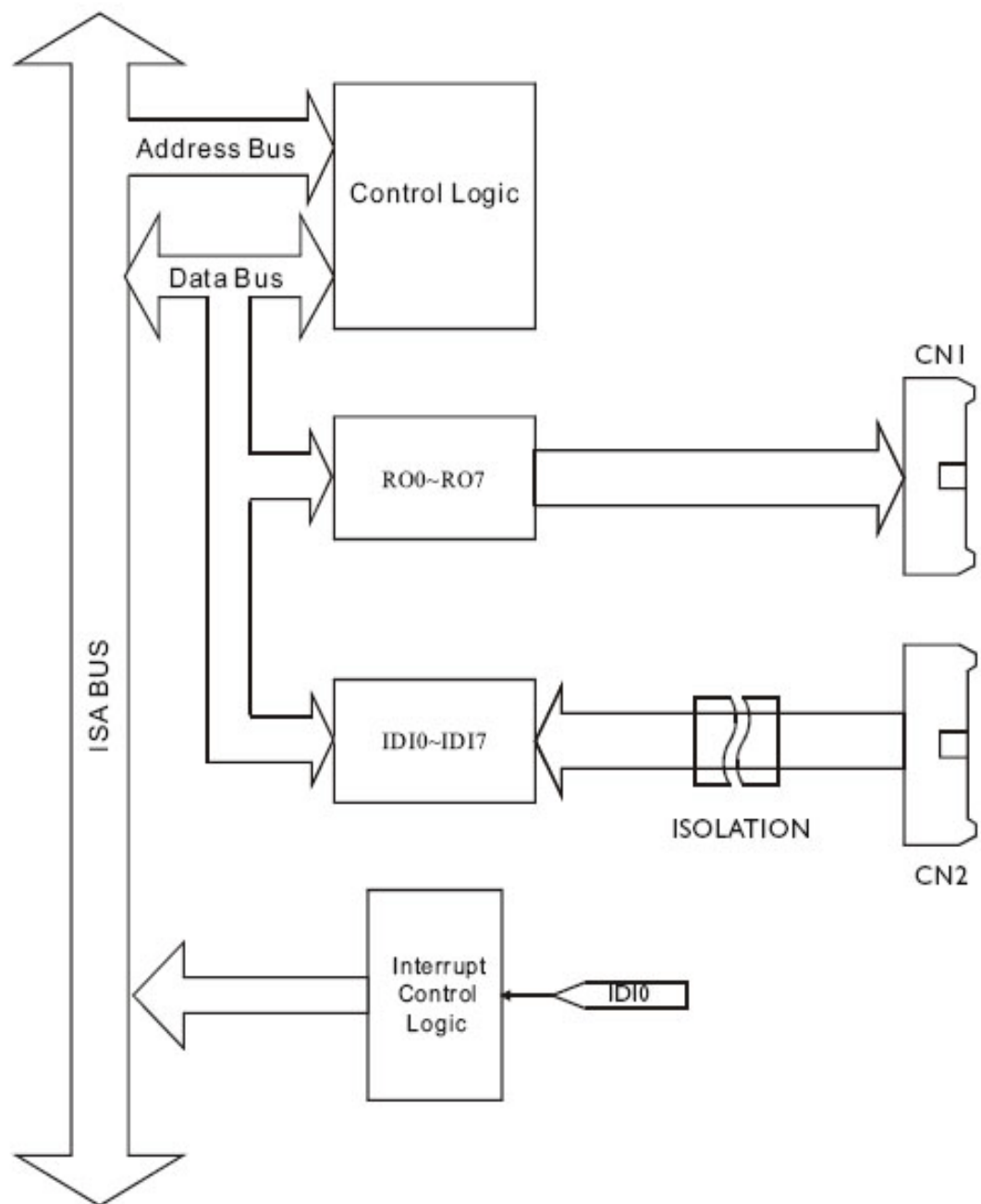
Chapter 2

Installation

2.1 Initial Inspection

As you unpack the PCM-3725, check it for signs of shipping damage (damaged box, scratches, dents, etc.). If it is damaged or fails to meet specifications, notify our service department immediately. We will then make arrangements to replace the unit.

Discharge any static electricity on your body before you touch the board by touching the back of the system unit (grounded metal).

Remove the PCM-3725 card from its protective packaging by grasping the rear metal panel. Handle the card only by its edges to avoid static electric discharge which could damage its integrated circuits. Keep the antistatic package. Whenever you remove the card from the PC, please store the card in this package for protection. You should also avoid contact with materials that hold static electricity such as plastic, vinyl and styrofoam.

2.2 Switch and Jumper Settings

The PCM-3725 card has one function switch and three jumper settings. The following sections tell how to configure the card. You may want to refer to the figure below for help in identifying card components.
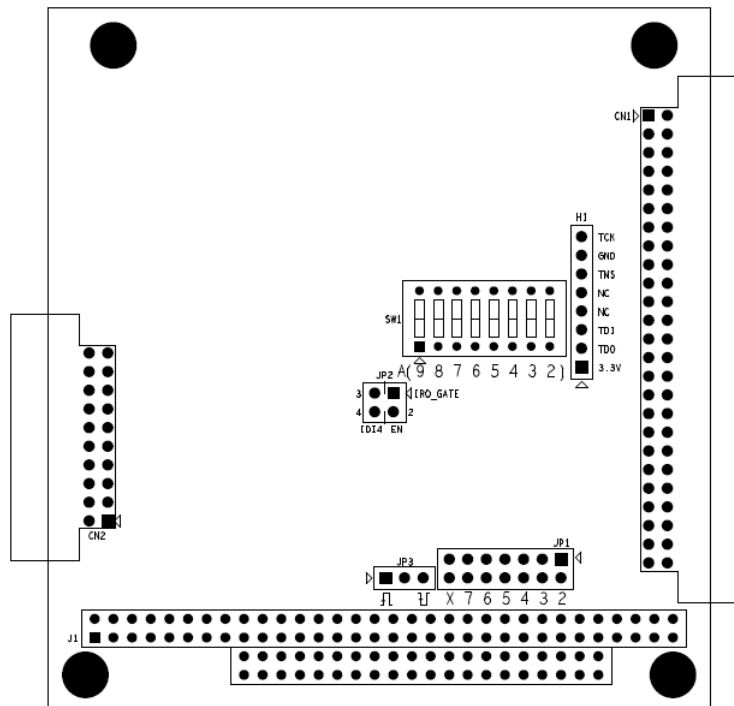

Figure 2.1 Card Connector, Jumper and Switches

Table 2.1: Connectors, Jumpers, and Switches	
Label	**Function**
CN1	Relay output
CN2	Isolated digital input
JP1	Interrupt level
JP2	Interrupt gate
JP3	Interrupt trigger
J1	PC-bus Connector
SW1	Card base address

Base Address Selection (SW1)

You control PCM-3725 operation by reading or writing data to the PC's I/O (input/output) port addresses. The PCM-3725 requires four consecutive address locations. Switch SW1 sets the card's base (beginning) address. Valid base addresses range from Hex 000 to Hex 3FC. Other devices in your system may, however, be using some of these addresses.

We set the PCM-3725 for a base address of Hex 300 at the factory. If you need to adjust it to some other address range, set switch SW1 as shown in the following table:

Table 2.2: PCM-3725 I/O Address

Card I/O Addresses (SW1)

Base address (hex)	Switch position							
	1	2	3	4	5	6	7	8
000	x	x	x	x	x	x	x	x
004	x	x	x	x	x	x	x	o
*300	o	o	x	x	x	x	x	x
3FC	o	o	o	o	o	o	o	o

o = Off   x = On   *=Default

Note: Switches 1-6 control the PC bus address lines as follows:

| Switch	1	2	3	4	5	6	7	8
Line	A9	A8	A7	A6	A5	A4	A3	A2

Interrupt Function

The isolated digital input channel IDI0 in PCM-3725 is connected to the interrupt circuitry that can be used to generate hardware interrupt.
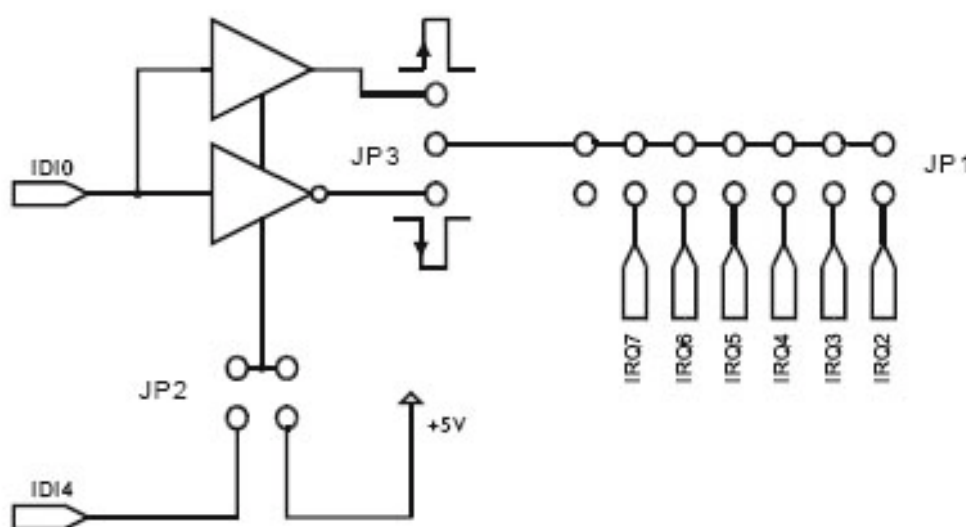
**Figure 2.2 PCM-3725 Interrupt Circuitry**

Interrupt Level (JPI)

Jumper JP1 controls the card's IRQ level, as shown below. Position X disables the interrupt.

JP1 Interrupt level

X 7 6 5 4 3 2

(default)
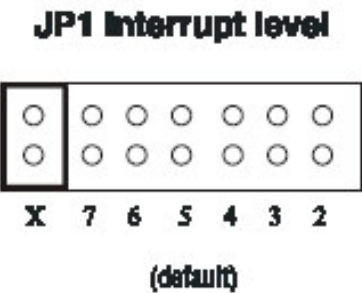
Interrupt Gate (JP2)

Jumper JP2 selects the gate mode of the card's interrupt. Jumper settings appear below:

JP2 Gate mode

IDI4 EN

Interrupt function is enabled by IDI4

IDI4 EN

Always enabled (default)
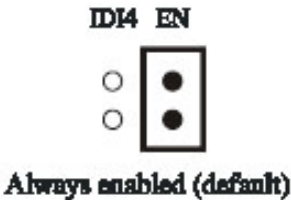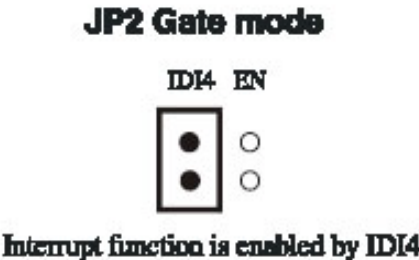
Interrupt Trigger (JP3)

Jumper JP3 selects the trigger edge (rising or falling) on which the card will trigger an interupt. Jumper settings appear below:

JP3 Trigger method

Rising edge interrupt triggering (default)

Falling edge interrupt triggering
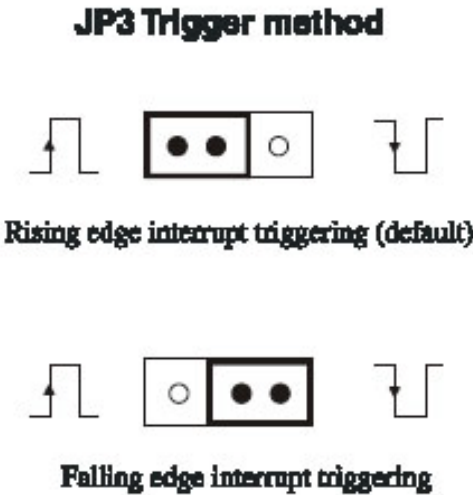
2.3 Connector Pin Assignments

The PCM-3725 has one on-board 20-pin flat-cable connector for isolated DI and one 50-pin connector for relay output.

Refer to the table below for abbreviations of the pin assignment.

Table 2.3: Abbreviations of Pin Assignment	
Abbreviation	**Description**
NCn	Normally closed pin of relay n
NOn	Normally open pin of relay n
COMn	Common pin of relay n
IDInH	Isolated digital input high, channel n
IDInL	Isolated digital input low, channel n
NC	No connection

Connector CNI - Relay Output

C0M0	1	2	C0M0
NC0	3	4	NC0
N00	5	6	N0O
C0M1	7	8	C0M1
NC1	9	10	NC1
N01	11	12	N01
C0M2	13	14	C0M2
NC2	15	16	NC2
N02	17	18	N02
C0M3	19	20	C0M3
NC3	21	22	NC3
N03	23	24	N03
C0M4	25	26	C0M4
NC4	27	28	NC4
N04	29	30	N04
C0M5	31	32	C0M5
NC5	33	34	NC5
N05	35	36	N05
C0M6	37	38	C0M6
NC6	39	40	NC6
N06	41	42	N06
C0M7	43	44	C0M7
NC7	45	46	NC7
N07	47	48	N07
NC	49	50	NC

Connector CN2 - Isolated Digital Input

IDI0H	20	19	IDI0L
IDI1H	18	17	IDI1L
IDI2H	16	15	IDI2L
IDI3H	14	13	IDI3L
NC	12	11	NC
IDI4H	10	9	IDI4L
IDI5H	8	7	IDI5L
IDI6H	6	5	IDI6L
IDI7H	4	3	IDI7L
NC	2	1	NC

2.4 Hardware Installation

Warning! TURN OFF your PC power supply whenever you install or remove the PCM-3725 or connect and disconnect Cables.

Installing the Module

1. Turn off the PC's power off. Turn off the power of any peripheral devices such as printers and monitors.
2. Disconnect the power cord and any other cables from the back of the computer.
3. Remove the system unit cover (see the user's guide if necessary).
4. Remove the CPU card from the chassis (if necessary) to gain access to the card's PC/104 connector.
5. Connect the connector J1 of the PCM-3725 to the PC/104 connec- tor. Care- fully align the pins to the PC/104 connector. Slide the module into the connec- tor. The module pins may not slide all the way into the connector; do not force the pins into place, or the module may be damaged.
6. Fasten the module to the CPU card by using the included brass screw. Screw the brass spacer into the threaded hole on the CPU card. Do not tighten too much, or the threads may be damaged.
7. Attach any accessories to the PCM-3725 using 20/50 pin cables.
8. Reinstall the CPU card and replace the system unit cover. Reconnect the cables you removed in step 2. Plug in and turn on the power.

This completes the hardware installation. Install the software driver as described in the following section.

Chapter **3**

Digital I/O

3.1 Digital I/O Programming

On the PCM-3725 card, 8 isolated digital input channels and 8 relay output channels are provided. Two I/O port addresses (started from BASE +0) are reserved for accessing these channels. The two addresses are allocated as:

BASE +0 R/O channel 0-7

BASE +1 D/I channel 0-7

A read operation on BASE +1 will read in the value (8 bits) of the 8 corresponding isolated digital input channels.

To access these channels on BASIC, use the statement: VALUE = INP (BASE +1)

A write operation on BASE +0 will set the desired status (1 = ON, 0 = OFF) on the 8 corresponding relay output channels. To program these channels in BASIC, use the following statement:OUT BASE, XYZ where XYZ should be a number between 0 and 255. The status of the relay output can be monitored by reading back the BASE +0 byte as: STATUS = INP (BASE)

3.2 Isolated Digital Input Connections

The PCI-3725 has 8 isolated digital input channels designated IDIO~IDI7.

Each of isolated digital input channel accepts 10~50 VDC voltage inputs, and accept bi-directional input. It means that you can apply positive or negative voltage to an isolated input pin (Vin). The figure below shows how to connect an external input source to one of the card's isolated input channels.
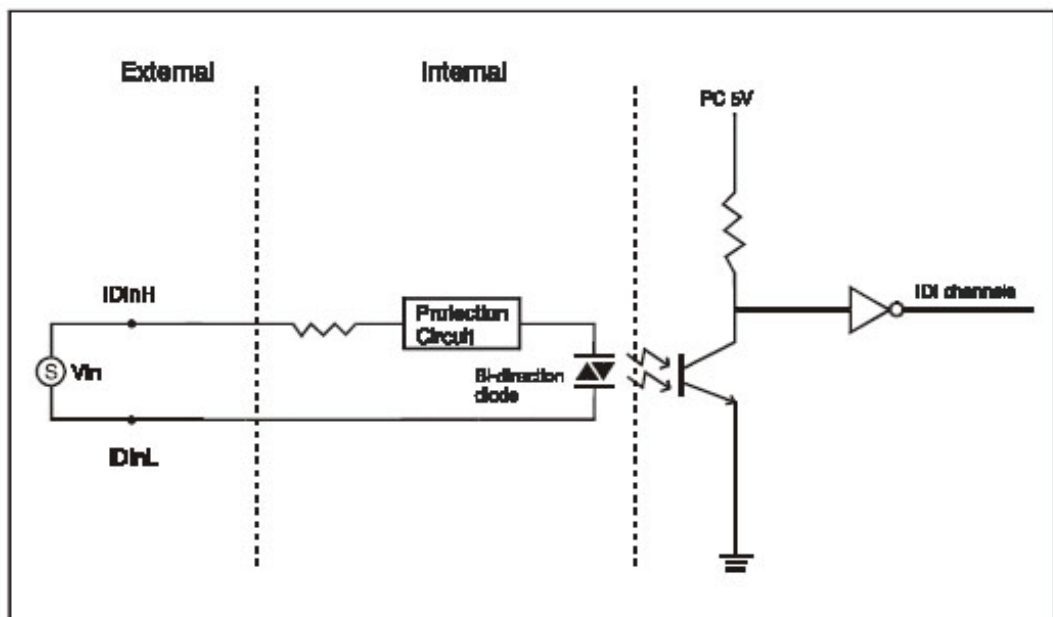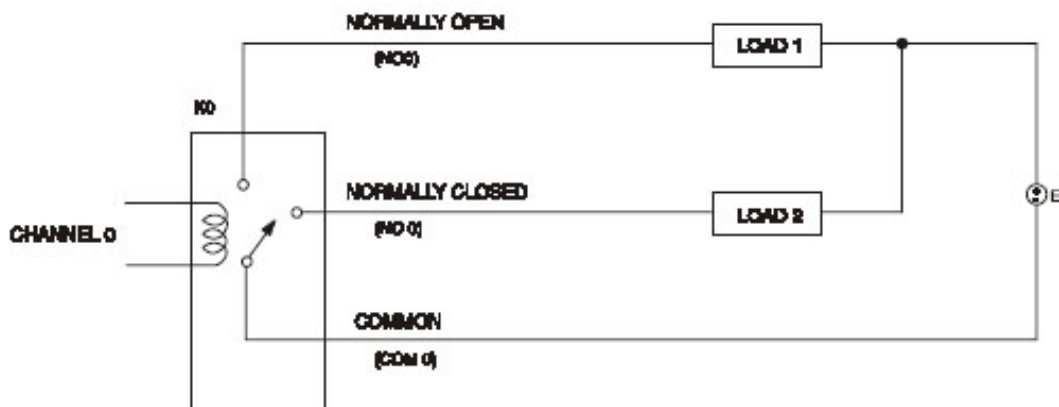

Figure 3.1 Isolated Digital Input Connection

3.3 Relay Output

After power on, the initial relay output status of PCM-3725 is shown as below:

Figure 3.2 Relay Output Connection

A write operation to I/O address, BASE +0, will change the output status of each relay. For example, if Bit 0 of BASE +0 is set "1" (logic high), relay 0, K0, will switch from position "NORMALLY CLOSED", NC0, to position "NORMALLY OPEN", NO0. This means that LOAD2 will be de-energized, while LOAD1 is energized.

To summarize, the "COMMON" line connect to the "NORMALLY CLOSED" line, if the corresponding bit is set as 0 (power-on initial status). Otherwise, if the corresponding bit is set as 1, then the "COMMON" line will connect to the "NORMALLY OPEN" line.

Chapter 4

Register Format

4.1 Overview

The PCM-3725 is delivered with an easy-to-use 32-bit DLL driver for user programming under the Windows 95/98/NT operating system. We advise users to program the PCM-3725 using the 32-bit DLL driver provided by Advantech to avoid the complexity of low-level programming by register.

The most important consideration in programming the PCM-3725 at the register level is to understand the function of the card's registers. The information in the following sections is provided only for users who would like to do their own low-level programming.

4.1.1 I/O Port Address Map

The PCM-3725 requires 4 consecutive addresses in the PC's I/O space. The address of each register is specified as an offset from the card's base address. For example, BASE+0 is the card's base address and BASE+1 is the base address plus one byte.

4.2 Register Format

Table 4.1: PCM-3725 Register Format									
Base Add.		7	6	5	4	3	2	1	0
0	R	Relay Output Read Back							
		RS7	RS6	RS5	RS4	RS3	RS2	RS1	RS0
	W	Relay Output							
		RO7	RO6	RO5	RO4	RO3	RO2	RO1	RO0
1	R	Isolated Digital Input							
		IDI7	IDI6	IDI5	IDI4	IDI3	IDI2	IDI1	IDI0
	W	N/A							

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